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ANALYSIS OF OILS, FATS, AND WAXES.

Chemical Analysis of Oils, Fats, and Waxes, and of the Commercial Products derived therefrom. From the German of Prof. Dr. R. Benedikt. Revised and enlarged by Dr. J. Lewkowitsch, F.I.C., F.C.S. (London: Macmillan and Co., 1895.)

TEN or twelve years ago, the analysis of oils was one of the most neglected branches of analytical chemistry. How the study of it has been taken up and developed since, may be gathered by turning over the 670 pages of this excellent volume, the first English work devoted exclusively to this subject. The information existing in 1882 was comprised within 140 pages (much smaller than these) of Allen's "Commercial Organic Analysis." In the second edition of the same work, published in 1886, the subject-matter had grown to 318 pages. Benedikt's "Analyse der Fette und Wachsarten," second edition, published in 1892, upon which the present work is based, contained 460 pages, and as the literature of the subject has accumulated since then, at an increasingly rapid rate, it is evident that a new volume was demanded, the preparation of which could not have devolved upon any one more capable than Dr. Lewkowitsch, whose practical experience in, and valuable contributions to, our knowledge of this branch of chemistry are well known. To regard this work merely as a translation of the work of Dr. Benedikt would, obviously, be absurd. As the author points out in the preface, every page bears evidence of the alterations and numerous additions which have been made. Obsolete processes have been abridged or entirely omitted, and the new work of the last four years has been sifted, and all that is of value has been incorporated, including a large number of the author's own experiments and observations hitherto unpublished. Benedikt's arrangement of the subject-matter has been generally adhered to, but an improvement has been effected by transferring to the end of the book the chapter on the analysis of soap, candles, glycerine, and other products of the fat industry.

The first two chapters contain a description of the sources and chief properties of the various acids and alcohols obtained, or derived by oxidation, from the fats and waxes, followed by an account of the chemical constitution and the chief chemical and physical characters of the oils, fats, and waxes themselves. Commercial fats and oils are not pure neutral bodies, but always contain more or less free fatty acids which, for some purposes, depreciate their value. The percentage of free acid is liable to increase on keeping, and it was until recently believed that the development of rancidity was connected with this change. But Ballantyne has disproved this by showing that an oil may become rancid without becoming acid, and Heyerdahl has proved that the converse may also be true. The discovery, by Kirchner, of micro-organisms in poppy-seed oil, lent support to the view that rancidity might be the result of a fermentation process; but Ritsert showed that a fat which had been sterilised by heating to 140° C., might subsequently become rancid if exposed to light and air. The latter investigator has also shown that moisture is by no means essential, and he has finally concluded that rancidity must be due to the direct oxidation of the oil or fat by the oxygen of the air acting in presence of light.

Chapter iii. describes the determination of water and other non-fatty admixtures, and the preparation of the pure fat for analysis. Then follow a chapter on the physical properties and methods of examining fats, and four chapters on chemical methods. In the two next chapters the application of the foregoing, and some other methods, to the examination of fats is discussed, and data obtained by submitting the various oils, fats, &c., to examination by each method are collected and arranged in tables. This, however, is hardly shown by the headings of the chapters. Thus, chapter iv., which is headed "Physical Properties of Fats and Waxes," should rather be "Physical Properties and Methods of Examining Fats and Waxes"; and chapters ix. and x., headed "Systematic Examination of Liquid and Solid Fats and Waxes," with the sub-headings "Physical Methods" and "Chemical Methods," would be better entitled "Application of the foregoing Methods to the Systematic Examination," &c., with sub-headings "Application of Physical Methods" and "Application of Chemical Methods." These eight chapters are admirably written, and the value of the information given is greatly enhanced by the able manner in which each method is discussed and criticised. The completeness of the treatment shows how thoroughly the author has ransacked the literature of the subject. Unfortunately the task of reading and sifting papers is rendered heavier than need be by the growing tendency to rush into print with trivial and ill-considered observations. Thus, "the excellent *Reichert-Meissl* process has not escaped the fate of nearly all modern methods used in fat analysis" (there is no need to limit the statement to fat analysis, as the literature of steel analysis would show), "viz., to receive at the hands of numerous analysts a number of supposed improvements, most of which are altogether insignificant and hardly offer any advantage whatever." Again, referring to the Hübl process: "The chemical literature of the last few years contains numerous papers by various authors purporting to give improvements or modifications of the original method. Most of these refer to minor and unimportant points, and some of them even reproduce methods which Hübl in his classical paper has rejected."

For the determination of unsaponifiable matter, the author recommends petroleum spirit in preference to ether, but he very rightly insists upon the necessity of carefully purifying and rectifying the spirit used. If this is not done, some of the lighter mineral oils occasionally used to adulterate rape oil, for instance, may be lost, and for that reason I prefer to use ordinary ether, which can be completely expelled at a very moderate temperature.

For the determination of resin, Twitchell's process is recommended as yielding the best results, but no process yet exists by which resin can be determined with absolute accuracy.

"If a correct method of determining accurately the oxygen absorbed were known, it would be possible to class the determination of the drying power, or, as it might be called, the 'oxygen value' amongst the quantitative reactions." Such an addition to existing methods would be of the greatest value in the examination of the

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various oils from cruciferous and other seeds which now pass under the name of "rape oil."

In the eleventh chapter, which extends over 273 pages, the natural oils, fats, and waxes are systematically arranged and separately described, a very excellent and most valuable feature being a series of tables appended to the description of each oil, fat, and wax, giving the physical and chemical constants (1) of the oil itself, (2) of the mixed fatty acids, and (3) of the wax alcohols. It is a pity these tables were not arranged so as to be readable without having to turn the book half round, which might have been done by cutting each table in half. No less than 106 oils, &c., are thus separately described, and their physical and chemical constants are collected and arranged in about 175 tables. The usefulness of these tables to the analyst cannot be over-rated, though it does not appear to be clear in all cases by what method the melting and solidifying points of the fatty acids were determined. The "saponification values" are expressed per mille, and the iodine and other values per cent., but there is no reason why the simpler plan of expressing all the quantitative values in percentages should not be adopted. The section on butter fat, the analysis of which was the first to be placed upon a scientific basis, occupies twenty-three pages.

In chapter xii. the analysis of the raw materials and products of the fat and oil industries is treated, and in the concluding chapter some examples of the interpretation of results are given; but space does not admit of further reference.

This book is unique: the analyst will find in it practically all the available information upon the subject up to date, with full references to the original papers; and it will increase the author's already high reputation.

L. ARCHBUTT.

TRACES OF A DELUGE.

On Certain Phenomena belonging to the Close of the last Geological Period, and on their bearing upon the Tradition of the Flood. By Joseph Prestwich, D.C.L., F.R.S., &c. (London: Macmillan and Co., 1895.)

HAD the story of the Deluge a foundation in fact; in other words, is it a record of some inundation which affected a considerable area of the earth's surface? This is the question which Prof. Prestwich sets himself to answer in the small volume before us—a volume which combines a paper read to the Victoria Institute with some of the material communicated to the Royal and the Geological Societies.

In the south of England, especially in the neighbourhood of the coast, a drift is often found, varying in thickness from a few inches to a few feet, which consists of angular fragments of rock with loam derived from adjacent higher ground, and lies on the slopes of the hills and at the bottom of the valleys. Frequently it is absent, but where hollows occur in the surface of the underlying rocks, it has accumulated in greater quantities, and occasionally even exceeds eighty feet in thickness. In some localities it rests on an old raised beach, and is banked up against a buried sea cliff; in others it fills up fissures in the rocks. In the last case it frequently contains the bones of mammals, many of them now extinct—at any rate in Britain. These are neither worn nor gnawed, but are commonly broken and split. Its fossils, almost without exception, are of terrestrial origin. Similar deposits occur in the Channel Isles and on the French coast, and in many places around the Mediterranean, not to mention others. What is the origin of this "rubble drift," "head," osseous or fissure breccia?

Prof. Prestwich refers all these deposits to one epoch of very limited duration. He supposes that there was a rather widespread subsidence, amounting, in some places, to a few hundred feet, during which the sea overflowed the lower land. This was sufficiently rapid to make the invading water muddy; then, before the marine molluscs had time to establish themselves in the new territory, the land was upheaved by jerks (with intervening pauses). These sudden disturbances of its bed set up currents in the sea, strong enough to sweep heavy débris, and even largish blocks of rock, from the higher to the lower ground, and to precipitate the material into any open fissures. By this tumultuous action the bones of the terrestrial mammals which had been drowned by the submergence would be dispersed and shattered, and it explains, in his opinion, all the phenomena better than any other hypothesis. As man was living at the time, it gave rise to the tradition of the Flood.

An adequate discussion of Prof. Prestwich's hypothesis is impossible in our limited space; but we may be permitted to remark that it is not free from serious difficulties. Many geologists would dispute the assumption that these deposits all belong to one and the same epoch. Others will doubt whether the sudden upheavals, which he postulates, would be adequate to produce currents, capable of moving the larger débris, or whether the earth movements would suffice, as he supposes, to make gaping fissures. Some will think that he hardly appreciates the effect of "cloud bursts," such as may be seen in many mountain and even lowland districts of Europe, in transporting débris very similar in character to the "head." It is admitted that since this was deposited denudation has wrought some changes in the contours of the country, and this may explain the apparent isolation of some patches of the "head," whether it fill fissures or cap tabular hills. In several cases the ordinary explanation of breccias (admitting as an adjunct the action of snow) seem to us more simple than that proposed by Prof. Prestwich, and his mode of accounting for the abundance of hippopotamus bones at San Ciro, near Palmero—that as the land sank they were embayed between its precipitous face and the advancing sea, and at last were drowned—can hardly be called probable. Lions and hyænas might have perished in that way, but the hippopotamus seems far from helpless in the water, and is likely to have saved itself.

We think, then, that Prof. Prestwich's hypothesis will be received with some scepticism; nevertheless, it demands careful consideration as an attempt to solve a very difficult problem, which is put forward by one who may now be termed the Nestor of British geologists, and who has paid especial attention to questions of this nature.

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